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Credit Rationing and Real Assets: Evidence from Italian Panel Data

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Abstract

This paper investigates empirically the role of real assets in credit rationing. When loans are collateralized, the amount borrowed is determined by the value of collateral. This happens because in a context of asymmetric information banks use real assets as a guarantee in the case of project's default.
Although many papers have explained the relationships between the debt level and the value of real assets, empirical evidence is mainly based on large "listed" firms. The question as to the whether these arguments are valid for smaller firms has received limited attention.
Many papers also show that specialized assets should fetch a low resale price. This suggests that a high resale price corresponds to a highly redeployable asset and that the reduction in resale value aggravates credit rationing, so that investment declines.
My purpose is to show empirically how the value of real assets explains credit rationing of Italian small and medium firms. It is interesting to analyze small and medium firms because of their ownership structure and size they have fewer financial options. Large firms can obtain credit on the public markets while small firms depend on financial intermediaries. This implies that their main source of funds is banks. These firms are more likely to face credit rationing or very high cost of non collateralized debt because banks resolve asymmetric information by charging higher interest rates or collateral requirement on small firms.

Introduction

The present work is aimed to study the relationship between fixed assets and credit rationing and the effect of public subsidies on credit rationing.
In the first part, the paper investigates empirically the relationship above.
The analysis is based on the idea that in a context of asymmetric information banks use real assets as a guarantee against project default.
Although many papers have explained the relationships between the debt level and the value of real assets, empirical evidence is mainly based on large "listed" firms. The question as to the whether these arguments are valid for smaller firms has received limited attention. One reason is that good data on smaller non-listed firms has not been available until very recently. Moreover, many papers focus on the credit rationing of high-tech firms because they have difficulty in borrowing long term and borrow at high spreads. Indeed, if a high tech project fails, there is no collateral to protect creditors.
Many papers also show that specialized assets should fetch a low resale price. This suggests that a high resale price corresponds to a highly redeployable asset and that the reduction in resale value aggravates credit rationing, so that investment declines (see also Affuso (2006)).
My purpose is to show empirically how the value of real assets explains credit rationing of unquoted small and medium firms. It is interesting to analyze small and medium firms which, because of their ownership structure and size, have fewer financial options. Large firms can obtain credit on the public markets while small firms depend on financial intermediaries. This implies that their main source of funds is banks. These firms are more likely to face credit rationing or a very high cost of non collateralized debt because banks resolve asymmetric information by charging higher interest rates or collateral requirement on small firms.
Although my work is close to other papers on capital structure, my perspective on the problem is slightly different. I consider the relationship between credit rationing and firms' capital structure, rather than the relationship between debt ratio and firms' capital structure.
In Section 2, I review some of the most relevant studies on capital structure. In Section 3, I present data and variables. In Section 4, I discuss the model. In Section 5, I show results of the probit analysis, in the last section I draw conclusions.

Related Literature

Many papers have explained that bank financing depends on whether the lending can be secured by tangible assets (Storey (1994) and Berger and Udell

(1998)). Moreover, from the literature emerges that several characteristics of a firm affect the level of indebtedness. In my paper, I use many of these characteristics as independent variables to explain credit rationing. In this Section I present some works that underline how the used variables are linked to the firm's debt level.

Titman (1984) suggests that firms manufacturing machines and equipment are financed with relatively less debt because they find liquidation especially costly. Indeed, when assets are highly specialized, their value to the firm is greater than their value to the marketplace. Firms with unique or specialized products therefore have relatively low debt ratios.

Leeth and Scott (1989) reject the hypothesis that the theories of secured debt wrongly predict collateralization, and demonstrate that collateral reduces net borrowing costs. Their analysis shows that the incidence of secured debt is strongly related to default probability, loan size, loan maturity, marketability of assets, economic conditions and legal framework.

Rajan and Zingales (1994) also demonstrate that leverage increases with fixed assets, non-debt tax shields, growth opportunities and firm size and decreases with volatility, advertising expenditure, bankruptcy probability, profitability and uniqueness of the product. Rajan and Zingales focus on four factors: tangibility of assets, the market to book ratio, firm size and profitability. If a large fraction of a firm's assets are tangible, then assets should serve as collateral diminishing the risk of the lender. They should also retain more value in liquidation. Therefore, the greater the proportion of tangible assets on the balance sheet, the more willing should lenders be to supply loans and the lower rationing should be.

Johnson (1997), analyzing the composition of debt, finds that firms with access to public debt markets use little bank debt, but borrow a substantial proportion of their debt from private non-bank lenders. Moreover, he finds a positive relationship between bank debt use and fixed asset ratio for firms with access as well as for firms without access to public debt markets.

Guiso (1998), in his analysis on high tech Italian firms, shows that the probability that a high tech firm is credit-constrained does not depend on the amount of collateralizable assets but on the level and composition of firms' liabilities. Indeed, a large share of short-term liabilities increases credit rationing.

Cassar and Holmes (2003), studying the determinants of capital structure show the differences between long and short forms of debt and underline that given the high proportion of short debt in the firms, overall leverage is negatively related to fixed assets, but long term debt structure is positively related to long term asset structure.

An important determinant of capital structure is also the past profitability of the firm. Profitable firms which have access to retained profits use these for firm financing rather than accessing outside sources.

At the same time, a rationed firm has a lower level of profitability because

when a firm is rationed it is excluded from the market, so it obtains a lower level of capital for investment. Rationed firms have a lower predicted performance.
Rajan and Zingales (1994) show that the correlation between the leverage of larger firms with profitability is more negative than the correlation between small firms and profitability.
Another important element is the firm's age because it is a reputational mechanism (Diamond, 1989). Reputation allows borrowers to obtain better cotract conditions and thus have more debt in their capital structure.
The literature also frequently finds a good predictor of difficulty in obtaining credit is firm size.
From Fazzari, Hubbard and Petersen (1987), several papers show that capital-market imperfections limit the availability of external finance to small and young firms. Particularly for smaller firms, any contraction in earnings reduces their total finance because they cannot easily increase their external finance.
In fact, bank credit rationing is less likely among “large” firms because they can more easily raise funds directly on the market, and because large firms are thought to be able to offer better collateral because their quality is clearer to financial intermediaries.
Titman and Wessels (1988) underline how size can be viewed as a proxy of the probability of default. Larger firms are generally more diversified and have less probability of going bankrupt.
In Rajan and Zingales (1994) the effect of firm size on leverage is ambiguous. Larger firms tend to be more diversified and fail less often, so size may be an inverse proxy for the probability of bankruptcy. However size may also be a proxy for the information outside investors have, which should increase their preference for equity relative to debt.
Beck, Demirguc-Kunt and Maksimovic (2005) have recently shown that small firms are significantly and negatively affected by financing obstacles: collateral requirement, bureaucracy, high interest rates, the need for special connections with banks, banks' lack of money to lend, and access to financing for leasing equipment.

Data

I use the *Capitalia* database containing data on a sample of Italian manufacturing firms. I use two samples, one for the period 1995-1997, and one for the period 1998-2000.
The samples were stratified according to size, industry and location and thus constitute a statistically significant representation of the Italian manufacturing industry. The database includes almost 500 variables; it provides information on balance sheet items, including assets, liabilities and their composition, as well as information such as ownership structure, availability of external finance, and entitlement to public subsidies.

The panel I analyze includes all those firms which were present in the database for the whole period 1995-2000. From the total sample I exclude the firms that have missing values for all the variables included in my analysis.
Small firms with less than 50 employees represent 60 percent of the observations, firms between 50 and 500 are 38 percent, and firms with more than 500 employees are 2 percent. To avoid problems with outliers this last category of firms was excluded.
I therefore consider 1209 firms corresponding to 5791 observations.
I assume that a firm is credit rationed if its answer to whether, at the current market interest rate, they wish to have access to a larger amount, is positive.

Variables

The dependent variable (*RATION*) I use in my analysis is the binary variable representing rationed firms. I use this factor to test the idea that credit rationing can be the rational response of the bank system to asymmetric information. As independent variables I use indicators of profitability, productivity, capital structure, bank indebtedness and geographical localization.
What I want to verify in my paper is whether fixed assets have a role in diminishing credit rationing for Italian small firms. So the most important variable in my analysis is *RASSET*, the share of fixed assets on total assets. As in Johnson (1997) I use it as a proxy for asset collateral value. In fact, tangibility eases the availability of debt and improves the terms on which debt is available.
The collateral value of fixed assets depends directly on the liquidation value, so it is possible to use this measure as a proxy for project liquidation values.
Because leverage is positively associated with liquidation value (Harris and Raviv 1990), liquidation value is negatively linked with credit rationing.
Another measure of collateral is the share of long term financial assets on total assets (*LTF*).
STF measures the ratio between short term financial assets, financial assets of less than one year maturity, and total assets. The market for short term financial assets is characterized by a great degree of “openess” in terms of the securitization of assets, so it may be considered another proxy for collateral.
Profitability is measured by the ratio of gross operating surplus on total sales (*GOSSALES*), while productivity is measured by the effect of sales per worker (*SALWORK*).
BANKLEV is the total bank debt of the firm divided by total liabilities. I use this variable because this type of financing is important to SMEs.
There are two geographical dummies to show geographical differences in Italy, *DUMNORTH*, for the North, and *DUMSOUTH* for the South.
The regressor *AGE*, which approximates the firm's reputation (Diamond 1989), is measured from the firm's year of foundation.
Several papers show that capital-market imperfections limit the availability of

external finance for small firms, so in order to consider firm size I introduce a dummy (*DUMSMALL*) which is 1 for firms with less than 50 workers, and 0 otherwise.

PAVITT3 is a dummy which identifies the prevalent activity sector among Specialized Sectors (Pavitt=3). I choose this because Leeth and Scott(1989) argue that the liquidation value of assets, and consequently their suitability as collateral, is lower when assets are highly specialized.

The Model

I test if fixed assets affect banks' rationing behavior. Following Guiso (1997), I assume that the decision to grant or refuse credit depends on a set of observable characteristics of the firm, identified by the vector X_{it}, where the index i refers to the firm and t to the year.

The bank observes the value of X and on the basis of the observed characteristics infers the quality of the firm. X includes only variables that can be observed, such as publicly available information, like firm characteristics and published balance sheet information.

Let P_{it}^{*} be the variable for the bank decision whether to finance firm i or not. I assume that P_{it}^{*} depends linearly on X:

$$P_{it}^{*} = \beta X_{it} + u_{it} \tag{1}$$

where β is a vector of coefficients and u_{it} an error term. P_{it}^{*} is a dummy variable which takes value 1 if firm i is credit-constrained and 0 otherwise. So:

$$prob(P_{it} = 1) = prob(P_{it}^{*} > 0) \tag{2}$$

Assuming that u_{it} is normally distributed, the vectors of parameters β can be estimated by maximum likelihood technique.

In my probit estimates, I use the Random-Effect model. The idea of the random effect model is to consider individual effects as latent random variables. When N is large and the sampling is truly representative of the population, the hypothesis underlying the RE model are satisfied.

For the random-effects model, the likelihood is expressed as an integral which is computed using Gauss-Hermite quadrature. I check the quadrature approximation used in the random-effects estimators and I choose the quadrature points for which the coefficients do not significantly change. The level I choose is 24. In fact, at a high number of points (greater than 20), the

results were more stable. Although the size of the coefficients varied according to the number of quadrature points, the findings were similar and the interpretation of the results did not change according to the number of quadrature points used.

Results

Table 1 reports descriptive statistics for the variables in the model, their sample mean, standard deviation and number of independent observations.
An examination of the correlation matrix of the sample data (Table 2) shows a critical value between *RASSET* and *STF*, but it should be noted that the large positive correlation may be caused by their common denominators (Titman and Wessels 1988).
Moreover, Long (1997) argues that if independent variables are highly collinear, a larger sample is required. He thus suggests that is risky to use maximum likelihood estimators with samples smaller than 100, while samples over 500 seem adequate. He claims that a rule of at least 10 observations per parameter is reasonable, even though this does not imply that a minimum of 100 is needed. My sample is large enough in order to satisfy the above conditions.
Multicollinearity is a problem for separation of the effects of two or more variables on an outcome variable. The problem occurs when independent variables are more highly correlated with each other than they are with the dependent variable. As the independent variables become more highly correlated, it becomes more and more difficult to determine which variable is actually producing the effect on the dependent variable.
The Variance-Inflation Factor (VIF) shows us how much the variance of the coefficient estimate is being inflated by multicollinearity. Typically, the threshold of VIF at which we consider multicollinarity to be a problem is 10 for each variable and is 6 for mean VIF. From my analysis, the singular VIFs are not higher than 1.9 and mean VIF is 1.28. Results of probit regression relating credit rationing to firm characteristics are in Table 3.
From the output of estimation, we can see that the Wald test rejects the hypothesis that all of the coefficients except the intercept are simultaneously equal to zero.
Analyzing the effects of the variables we can see that the effect of sales per worker is negative and strongly significant while gross operating surplus as a share of total sales has a positive but not statistically significant effect. This positive sign confirms, although not statistically, the pecking order theory that firms prefer internal to external financing (Myers, 1984, and Myers and Majluf, 1984).
Bank indebtness strongly affects the probability of being rationed. It means that indebted firms have more difficulties in obtaining other funds.

The measures of collateral negatively affect the probability of a firm being denied credit. In fact, the share of long term financial and real assets of total assets both have a negative and significant effect. In this case, the positive incentive effect of collateral requirement prevails over the negative selection effect (Stiglitz and Weiss, 1981).
Short term financial assets also have a negative and significant effect.
Moreover, the probability that a firm will be rationed does not depend on its location. Firms in the South are not more rationed than firms in the North.
The analysis of the regressor firm's age, measured from its year of foundation, shows that it is negative. This is consistent with the argument that the reputational capital of older firms reduces credit constrain, but this effect is not statistically significative.
The firm size dummy does not signal a high difficulty of small firms in obtaining credit.

I also compute the Marginal Effects at the sample means of the variables to gain an impression of the magnitudes of the changes in the probability of being rationed. The computation of the marginal effects at the sample means is shown in Table 6. The estimates show how the probability of being denied credit changes when the variables move from zero to their mean value.
When the variable *RASSET* changes from zero to its mean, the probability of being denied credit decreases 2.7 times. These results are consistent with previous findings.

Conclusions

The findings of the paper suggest that real assets are important in diminishing a firm's credit rationing.
The idea I test is that firms with more tangible assets have higher debt levels, particularly when loans are collateralized.
In the analysis I assume that the decision to grant or refuse credit depends on a set of observable characteristics of the firm.
I find that collateral is negatively correlated to rationing.
In fact, measures of collateral negatively affect the probability of a firm being denied credit; the shares of long term financial and of real assets of total assets both have a negative and significant effect.

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Table 1: Summary Statistics

Variable	Mean	Std.Dev.	Min	Max	Observations
RASSET	0.235	0.149	0	0.912	5855
STF	0.523	0.162	0.001	1	5855
LTF	0.034	0.067	0	0.928	5855
BANKLEV	0.178	0.177	0	0.737	5855
AGE	24.596	18.064	0	146	6249
GOSSALES	0.105	0.078	-1.03	1.333	5839
SALWORK	286.590	377.943	0	15730.6	6291
WORKERS	62.681	81.510	1	500	6306

Table 2: Correlation Matrix

	RASSET	*STF*	*LTF*	*BANKLEV*	*AGE*	*GOSSALES*	*SALWORK*	*DUMSOUTH*	*DUMNORTH*	*DUMSMALL*	*PAVITT3*
RASSET	1										
STF	0.590	1									
LTF	0.252	0.297	1								
BANKLEV	-0.042	0.026	-0.056	1							
AGE	0.187	0.240	0.065	-0.064	1						
GOSSALES	-0.245	-0.201	-0.076	0.051	-0.126	1					
SALWORK	0.132	-0.025	0.049	-0.197	0.125	-0.149	1				
DUMSOUTH	-0.053	0.005	0.086	0.217	-0.180	0.018	0.127	1			
DUMNORTH	-0.002	-0.096	-0.002	0.153	-0.302	-0.074	0.099	0.589	1		
DUMSMALL	0.169	0.121	0.289	0.257	0.179	-0.071	-0.094	0.155	0.128	1	
PAVITT3	-0.001	-0.019	-0.020	0.070	-0.031	-0.055	0.140	0.040	-0.038	-0.136	1

Table 3: Probit Estimates

Variable	Coefficient	Std. Error.	z	p>IzI
RASSET	-0.8925	0.4174	-2.14	0.032
STF	-0.8116	0.3849	-2.11	0.035
LTF	-1.8088	1.0322	-1.75	0.080
BANKLEV	0.7607	0.2569	2.96	0.003
AGE	-0.0032	0.0033	-0.97	0.331
GOSSALES	0.4700	0.5853	0.80	0.422
SALWORK	-0.0008	0.0003	-2.94	0.003
DUMSOUTH	0.1007	0.1713	0.59	0.557
DUMNORTH	0.0364	0.1252	0.29	0.771
DUMSMALL	0.0919	0.1047	0.88	0.380
PAVITT3	-0.0558	0.1080	-0.52	0.605
Cons	-7.1879	25.8671	-0.28	0.781
Number of observations	5791			
Number of firms	1209			
Wald chi2(11)	21.32			
Prob>chi2	0.0302			
Log Likelihood	-1441.731			

Table 4: Frequencies of actual and predicted outcomes

		Predicted		
		D=0	D=1	Total
Actual	D=0	4916	12	4928
	D=1	860	3	863
	Total	5776	15	5791

Table 5: Frequencies of actual and predicted outcomes

		Predicted		
		D=0	D=1	Total
Actual	D=0	1427	3501	4928
	D=1	135	728	863
	Total	1562	4229	5791

Table 6: Marginal Effects

Variable	Coefficient
RASSET	-0.027
	(0.012)**
STF	-0.024
	(0.011)**
LTF	-0.055
	(0.031)***
BANKLEV	0.023
	(0.007)*
AGE	-0.000
	(0.000)
GOSSALES	0.014
	(0.017)
SALWORK	-0.000
	(0.000)
DUMSOUTH	0.003
	(0.005)
DUMNORTH	0.001
	(0.003)
DUMSMALL	0.002
	(0.003)
PAVITT3	-0.001
	(0.003)

****,**,* represent significance at ten, five, and one percent levels, respectively.*

Table 7: ATT Estimates

	Nearest Neighbor	Kernel
Estimate (ATT) t-value	-0.038 -2.488	-0.025 -2.104
n. treated n.controls	2270 1250	2270 2716